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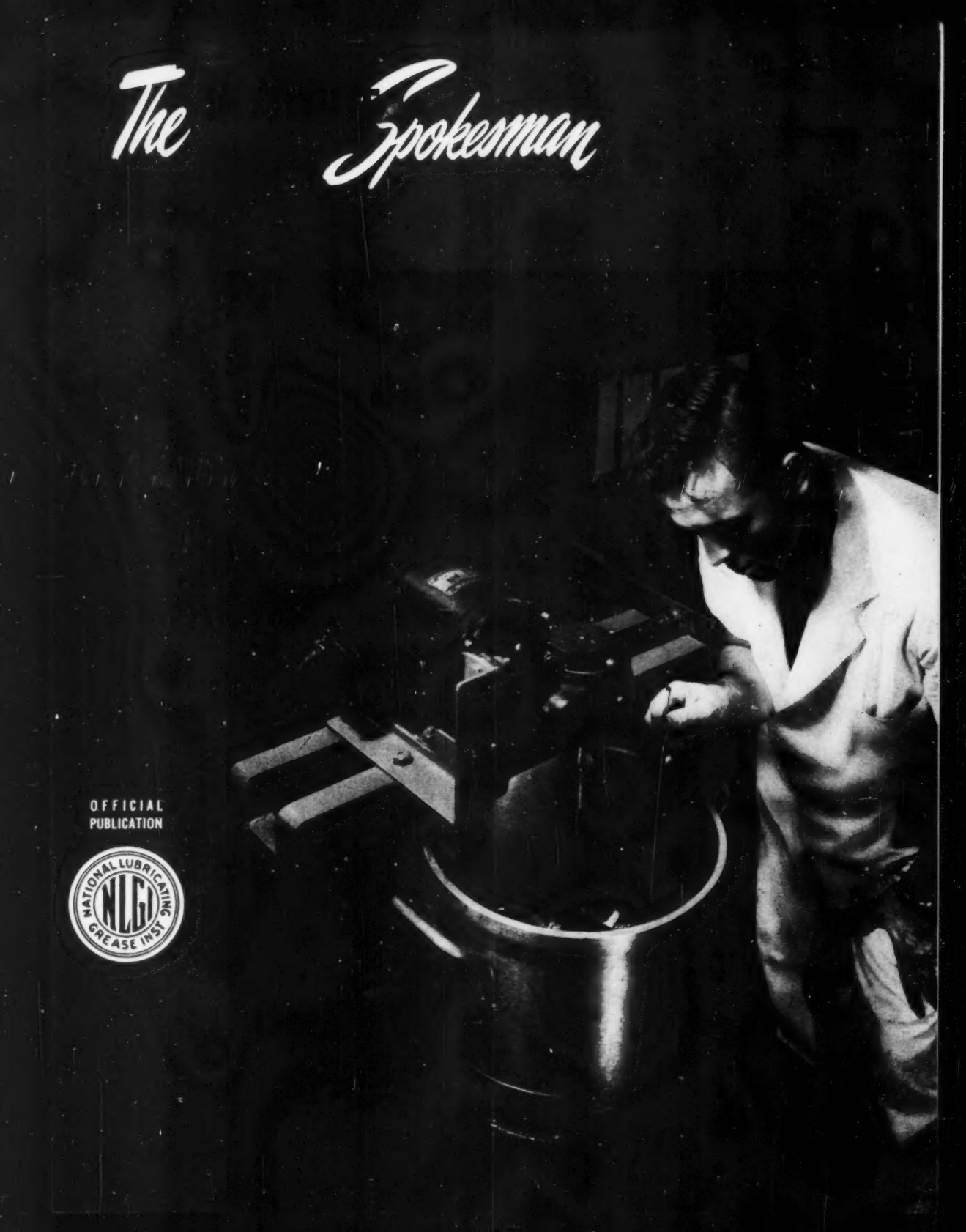
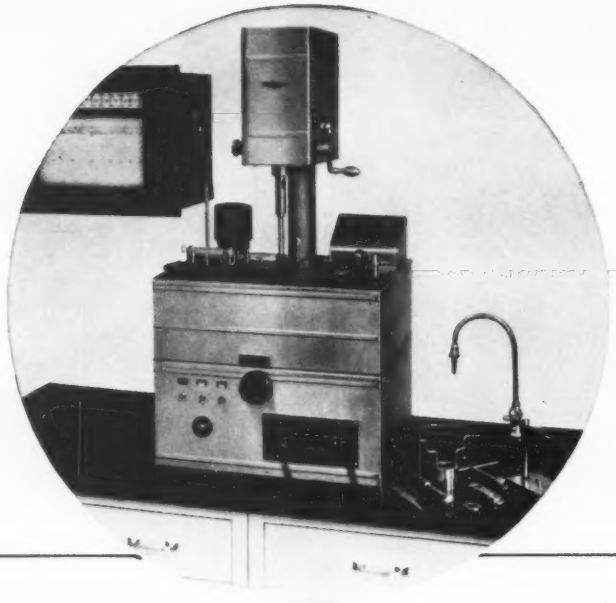


OFFICIAL PUBLICATION

NATIONAL LUBRICATING GREASE INST. NLGI



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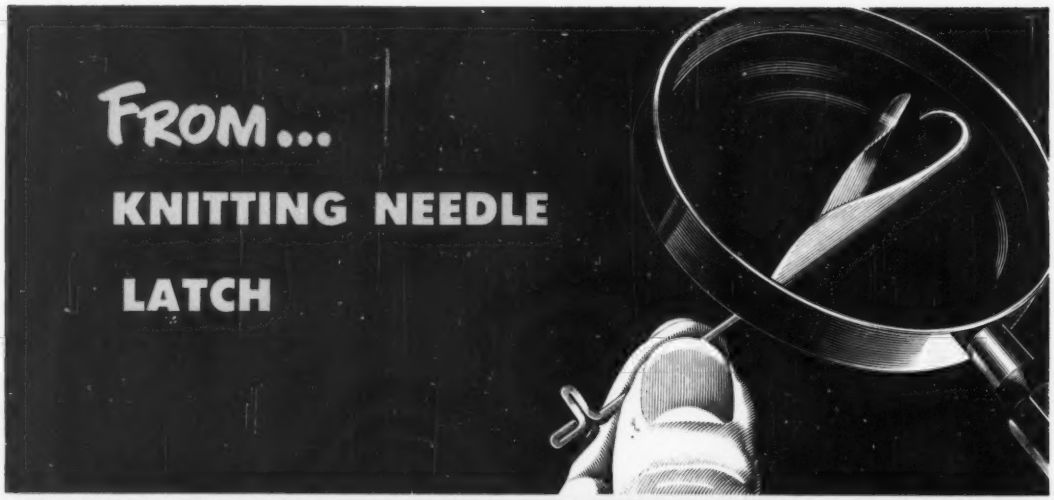

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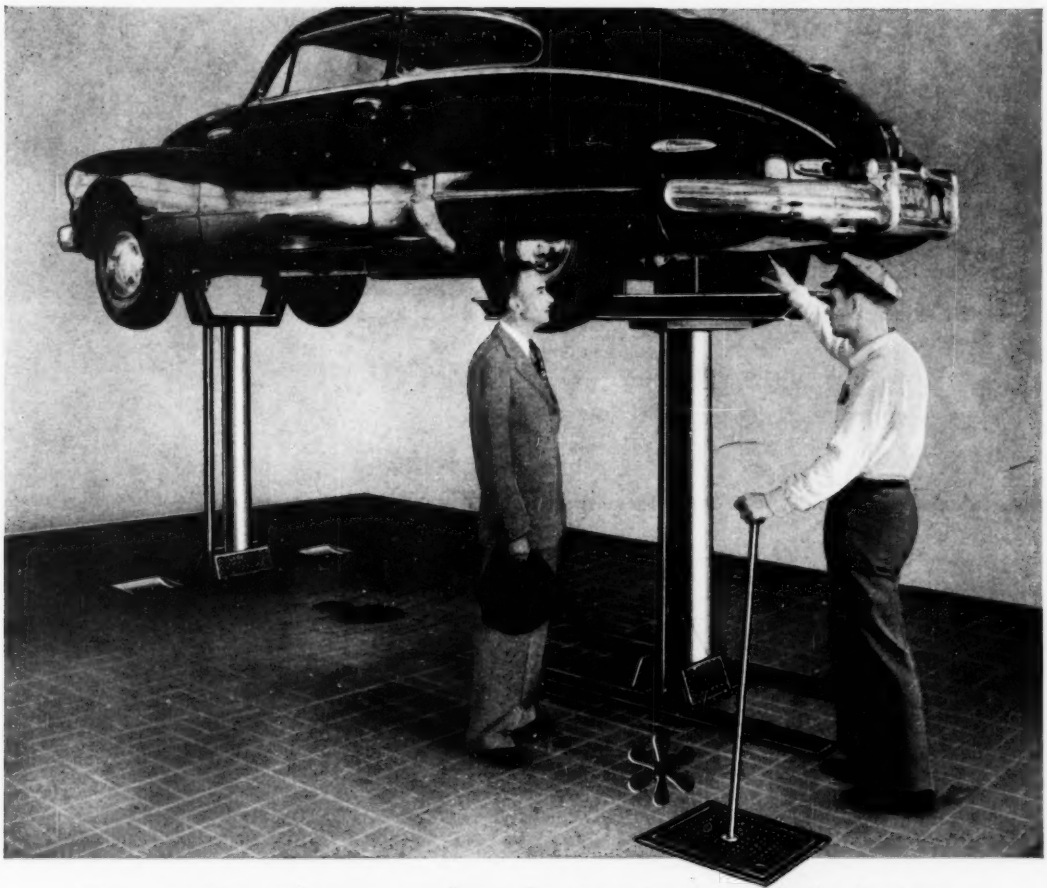

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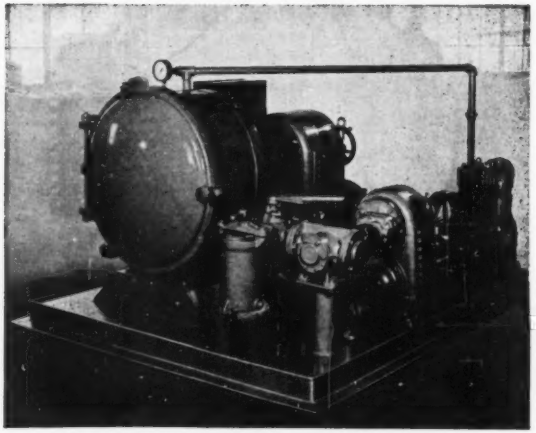

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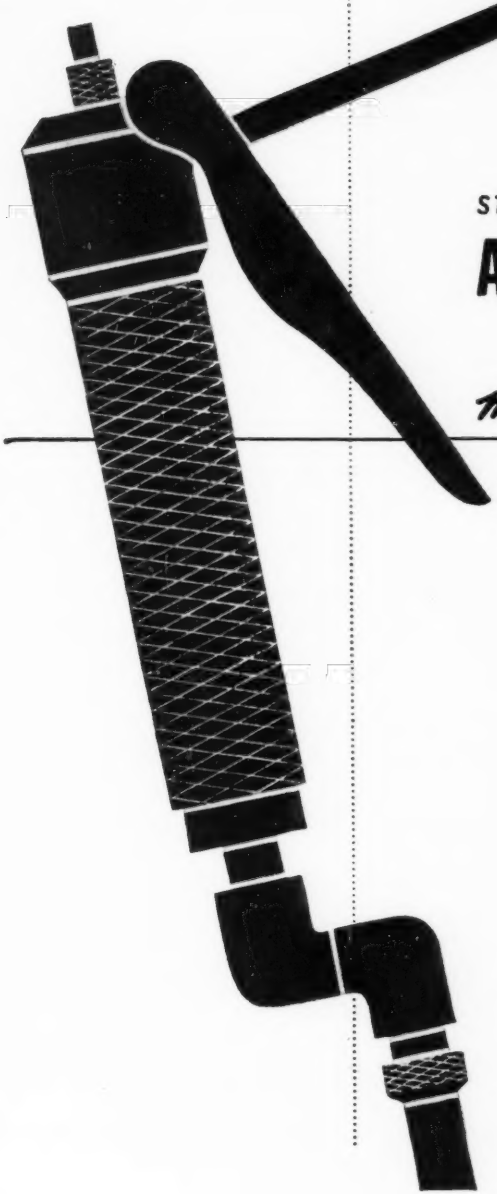

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ABOUT THE COVER . . .

Correlation of small scale grease batches with actual plant kettle results presents a rather challenging problem to grease makers, technicians and suppliers. The cover picture of this issue of THE INSTITUTE SPOKESMAN shows how the Witco Chemical Company endeavors to overcome this difficulty.

This illustration shows the first stage of grease manufacturing: the addition of the stearate to a small portion of the oil. Pictured is a rather simply constructed grease kettle capable of making batches up to forty pounds in size. The cooling pan and cabinet are shown directly in back of the operator.

The kettle is cast aluminum, equipped with handles and mounted so as to be readily removable for ease in pouring and cleaning. It is provided with paddle type agitators driven at 36 RPM by a gear head motor. A double gas burner serves as an easily controllable source of heat.

Aluminum stearate gels thus prepared are panned in layers of three inches in depth and cooled in an insulated cabinet or electrical oven at desiccated cooling rate conditions.

The results obtained in this equipment are reproducible from batch to batch and the results obtainable on a plant scale are often predicted with surprising accuracy.

INSTITUTE SPOKESMAN GETS A NEW CHASSIS

Look sharply at the Spokesman you have in front of you. See anything different? Take another look. Do you see it now? You're right, it's a new body type that we will use from now on.

This new type was originated by the New York Times and is called "Times-Roman". Sure we are proud of it because it is the latest thing and will give you "SPOKESMAN" readers an easier type to read because it is smooth and clean looking.

Our technical articles are as new as tomorrow and we want our publication to keep step with the latest developments in the printing craft.

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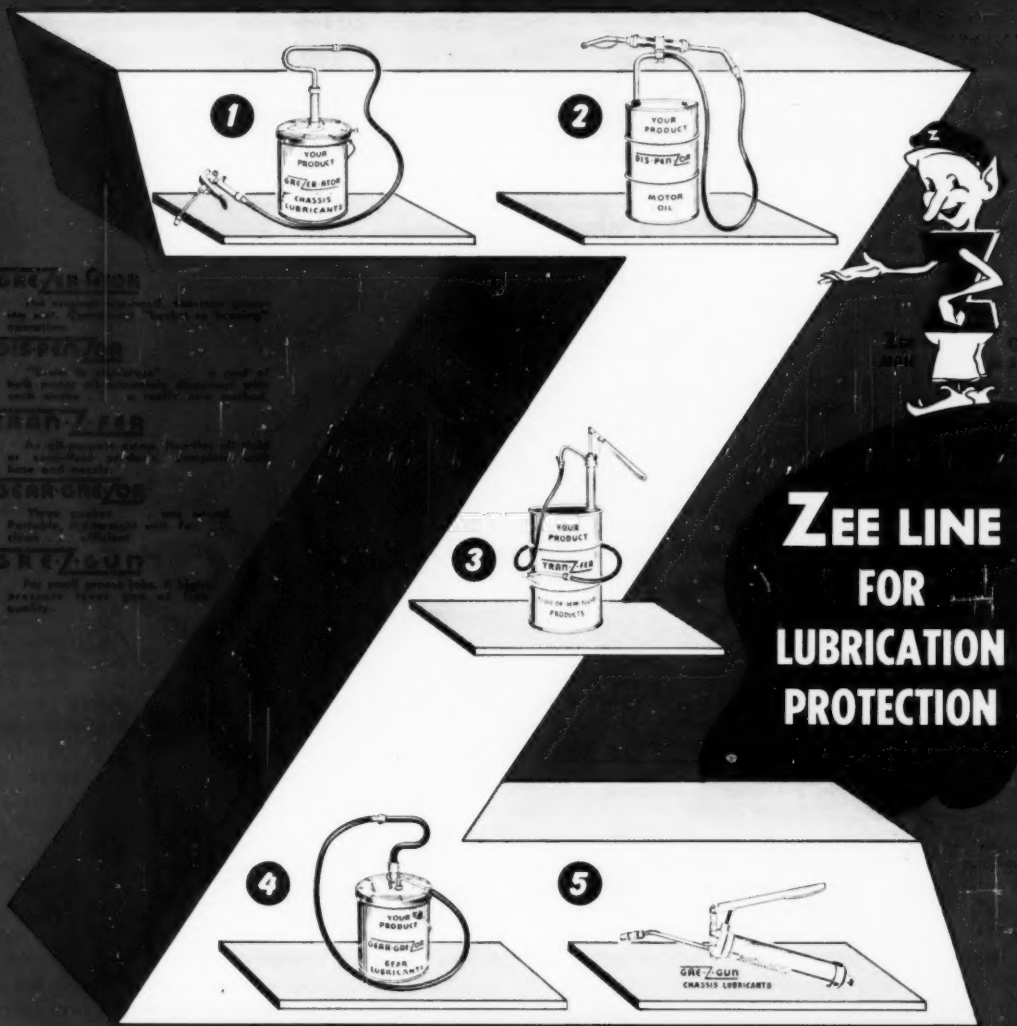

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Books and Publications

. . . About the Industry

Melting and Solidification of Fats and Fatty Acids
By Alton E. Bailey, Votator Division Girdler Corp., Louisville, Ky. approximately 400 pages, 150 illustrations, 66 tables.
(Fats and Oils) In preparation.

In preparing this volume, a first object has been, of course, to collect from rather widely scattered sources all available material on the subject. A second object—and one sought as diligently as the first—has been to correlate and interpret the experimental data in such a manner as to reveal the interrelationships between different phenomena associated with phase transformation, as well as the systematic variations that occur in specific properties of fats with similar variation in their molecular structure. The text has been written primarily for the practical oil and fat chemist or technologist, although it is believed that portions may be of interest to physical chemists at large. Since the melting behavior of fats is unintelligible without consideration of their polymorphism—a matter of internal crystal structure—all available x-ray diffraction data are included. Fat mixtures are treated (because these are of paramount practical interest), including insofar as was possible the complex mixtures comprising commercial fats. A chapter is devoted to the solubility of fatty substances in organic solvents, for this subject constitutes a special case of mixed melting.

CONTENTS—I. General and Theoretical Considerations. II. Laboratory Techniques. III. Melting and Solidification of Pure Compounds. IV. Melting and Solidification of Mixtures. V. Solubility. VI. Practical Melting and Solidification Processes. Index.

Lubrication
By Arthur Edwin Norton, late Professor of Applied Mechanics, Harvard University. Edited by J. R. Muenger, formerly Assistant in Mechanical Engineering, Harvard University.
244 pages 6x9, 115 illustrations (1942) $3.50

Offers students and practicing engineers a thorough understanding of the proper lubrication of machine bearings. The book develops the hydrodynamic theory of bearings from the simple concepts of viscosity and laminar flow, and discusses viscosity measurement, the properties of lubricants, and the practical considerations of bearing design.

Petroleum Mechanical Engineering
Proceedings of the 1947 Conference Published 1948 $4.50

The information in this book will prove of considerable interest to those in the petroleum industry for it makes available twenty articles dealing with materials, their construction and service length; equipment manufacture and application; production-application of equipment and factors to be considered in their selection, etc.; refining—use of internal insulating piping and pressure vessels for high temperature service, etc.; and transportation—crude and fuel oil handling; factors influencing co-managing in products pipe line; electric driven centrifugal compressors for new gas transmission, etc.

Oil Shales and Shale Oils
By H. S. Bell, Chemical Engineer

The critical importance of our oil reserves—which is reflected in steadily growing consumption and rising prices—has increased greatly the present value and future possibilities of the oil-bearing shales. They are discussed in detail in this complete book, which covers every operation in their technology, including their mining, crushing, retorting, oil refining and residue disposal—in short, every step in their utilization. All this information is fully illustrated with detail diagrams of apparatus, flow sheets of processes, layouts of plants, and complete data on the characteristics of machines. This great fund of technical experience covers the practice in all countries of the world, including the United States, and also contains new developments proposed by the Bureau of Mines to meet American problems in shale mining and processing. Besides its wealth of technical information, this book covers thoroughly the economic background of this entire industry, to establish the conditions under which it can make an immense addition to the oil production of the United States and the rest of the world.

Precision Redesigns Viscometer Operating Parts in One Housing

Precision Scientific Company has completely redesigned the Interchemical Rotational Viscometer and placed all operating parts within one housing. The housing table top contains controls and dials within easy reach of the operator, making the apparatus simpler to manipulate.

The viscometer has a broad utility and will give complete data on the flow properties of greases, paints, printing inks, plastics, adhesives, food products, and many other similar industrial products.

The Interchemical Viscometer produces consistency curves in place of single point measurements which are usually misleading for plastic, thixotropic materials. It consists essentially of a rotating sample cup and a stationary bob immersed in it. When the cup is rotated, the viscous drag on the bob is imposed on a coiled spring which is twisted through an angle measured on a calibrated disk. The speed of cup rotation can be varied from 10 to 400 rpm in steps of 10 rpm with the General Electric Thy-Mo-Trol drive.

The consistency curve is produced by changing the speeds over a series of steps from low to high and back again and noting the corresponding deflections of the graduated disk. Forty changes in speed are possible in three minutes. Breakdown of thixotropic materials can be obtained from the hysteresis loop formed by plotting together the up- and down-curves. Calculations using either the area of this loop, or two down curves, each at different top speeds, give the magnitude of the breakdown. From the down curves, Newtonian and plastic viscosities in the range of 1 to 2500 poises and yield values up to 180,000 dynes/cm^2 may be determined.

President's page

by B. G. Symon, President N.L.G.I.

With the Annual Meeting just around the corner, this is an appropriate time to review the growth and accomplishments of the N. L. G. I. down through the years. The Institute's history is one of service to its members and of constant efforts to increase its usefulness.

The Institute has experienced a remarkable growth since 1933 when it was founded by J. R. Battenfeld, W. H. Saunders, Jr., and Guy Peters, for the purpose of writing a code for NRA. Only 20 men, representing 20 companies, were present at the organizational meeting at the Stevens Hotel, Chicago. Membership today includes 90 per cent of the grease manufacturing industry, plus many associate members. The Institute is now international in character with members in Australia and Canada. During the16 years of its existence, it has so expanded the scope of its activities that it has gained international recognition for contributions to the industry's welfare.

I should like to enumerate these contributions in detail, but there is space here to mention only a few.

First: **The N. L. G. I. classification of greases by consistency numbers.** This has been adopted by practically all grease manufacturers as well as the U. S. Government.

Second: **Publication of THE INSTITUTE SPOKESMAN.** The Spokesman was started in 1937 at the suggestion of Homer Wilhelm, who was then president of the Institute. From an initial circulation of 200, it has grown to many times that amount, and is now distributed to countries all over the world. It has become **the** outstanding magazine of the grease industry.

Third: **Distribution of technical information.** To the best of my knowledge, the N. L. G. I. office is the only central gathering point in the world for technical information on lubricating greases. Such information is released to members through the Spokesman, and through special reports and bulletins. The presentation of papers at the Annual Meeting aids in this unique and valuable interchange of technical data. In fact, the Annual Meeting has come to be recognized as the national forum for problems in the grease manufacturing field.

Fourth: **The work of the N. L. G. I. Technical Committee.** This committee, composed of some of the outstanding lubricating grease technicians in the country, is currently engaged in a project requiring seven laboratories to determine the delivery characteristics of dispensing equipment. Any difficult problem pertaining to greases and grease lubrication may be brought to the committee for cooperative study by leading specialists in the field.

Sixteen years is a relatively short period of time as trade associations go. But we can be proud of what the N. L. G. I. has accomplished in this period, both because of its contributions to the economic welfare of the industry and the services it has performed for the benefit of the public.

Recent Developments in Aluminum Stearates

K. Parker and E. F. Wagner
Witco Chemical Company

SUMMARY

Development of aluminum stearates specificially for the grease industry is described. Test results are presented on greases prepared with four typical base oil stocks. The economy, stability, and handling of high yield aluminum stearates are discussed. Objectives of future development work are given along with the suggestion of much closer technical cooperation between grease and stearate manufacturers for their mutual benefit.

INTRODUCTION

Aluminum soaps were patented for grease manufacture some seventy years ago, and have been used extensively for approximately twenty years. However, it has only been recently that some intensive work has been done toward ascertaining the actual mechanism and phase behavior by which the soap-oil system assumes a plastic gel structure[1]. Simultaneously, more efficient soaps are being built, which give maximum economy and quality when used for the production of commercial products. The intent of this paper is to describe the progress which has been made in the latter direction.

The applications of aluminum stearate greases appear to be growing in number and today aluminum base greases make up a substantial part of total grease production. The favorable characteristics of aluminum base greases are transparency, clarity, water repellency (non-emulsifying), medium high dropping point, good pumpability, and wide possible range of consistency.

These properties are responsible for the acceptance and usage of aluminum base products as

Semi-fluid lubricants
Track roller greases
Pressure system greases
Chassis lubricants
Ball and roller bearing greases (low speed)
E. P. Gear Lubricants (mild)
Steering post greases
Water pump greases
Spring lubricants
Graphite greases
Covering and slushing compounds

Aluminum soaps are also used with calcium or soda soaps in the preparation of mixed base products to obtain a combination of desirable characteristics. High cost as compared to calcium and sodium, poor worked stability, and certain difficulties of production have limited the usage of aluminum type greases. Extensive development work by stearate manufacturers has succeeded in minimizing some of these deficiencies and further improvements can be expected in the future.

(1) Gerould H. Smith, *J. Oil Chem. Soc.*, Vol. 24, p. 353 (1947).

THEORETICAL CONSIDERATIONS

Since aluminum is a tri-valent metal, there is considerable latitude in formulating so-called mono, di-, and tri-stearates. From a thorough evaluation of all possible variations of the fatty acid to aluminum oxide ratio it is recognized that the di-stearate has the highest gelling characteristics.

The other basic modification which can be made is in the type of stearic acid employed. The grease maker well knows the importance of proper selection of fats and fatty acids. During the last few years, stearic acid manufacturers have installed efficient fractionation and purification equipment. A greater variety of uniform raw materials has therefore become available from a number of sources. Proper selection and blending of these has made possible aluminum di-stearates with greatly improved gelling characteristics.

In the manufacture of aluminum stearates, the double decomposition method employing caustic, stearic acid, and aluminum sulfate is still preferred since it permits most careful control of reaction conditions. Time, temperature, dilution, and rate of addition of reactants all have a definite influence on the characteristics of the product obtained. It is desirable to hold soluble salt and moisture contents of the finished stearate to a minimum, and to hold the free stearic acid content within well defined limits. The progressive stearate manufacturer, using continuous and rigorous production control methods, can now assure uniformity from shipment to shipment.

In our laboratory all batches of grease grade stearates are evaluated in a typical grease formulation. A 6% grease is prepared on a one-pound scale from a 300 SSU at 100°F. acid treated Mid-Continent stock. This is tested for consistency and worked stability. The same procedure is used for preliminary screening of experimental products. The stearate is thoroughly dispersed in the cold oil and the mixture is then heated to 300°F. on an electric hot plate with constant agitation. The cooling stage is carried out either in a preheated oven or in an insulated drawer of a cabinet. The grease is allowed to rest undisturbed for at least eighteen hours before penetration and working tests are made according to ASTM procedures. Observations on color, clarity, and bleeding of the finished grease are also made.

During the development stage a new stearate is evaluated in other oils obtained from different grease manufacturers and using various soap concentrations. When necessary, greases are also prepared on a 25-pound scale in a small pilot kettle and cooling pan arrangement.

RESULTS

Results presented in this paper are primarily concerned with stearates recently developed in our laboratory, which are now rather widely used in the grease trade. Representative high quality products of other manufacturers are also included. Tables I, II, III, and IV show unworked and worked penetrations of greases made with four different base oils.

Stearate A is a typical aluminum di-stearate which was available to grease makers before specific development work was begun to provide improved products.

Stearate B was designed to give a very definite improvement in yield while still permitting the use of rather simple grease working equipment. Thus a conventional gear pump and screen arrangement will generally handle the cooled panned product. The character of the base oil does not seem to have much effect on yields obtained, and it will be noted that after 5000 strokes working a soap content of 6% or slightly above will make greases on the upper limit of No. 1 NLGI consistency. It will further be noted that Stearate E falls into this same classification. It thus appears that this type of stearate with its economy advantage over the old lower gel types should find widespread usage.

Stearate C is shown to be one giving yields higher than those attainable with Stearate B. While very efficient in each type of oil, it has been found to be particularly effective in high viscosity index Pennsylvania base stocks. It must here be emphasized that as the efficiency of the stearate is increased, the problem of graininess generally becomes more acute. Therefore, working of the hard gelled product is usually necessary which is more intensive than that obtained in a gear pump. Other available products (Stearates D and F) appear to fall into this same category where a 6% soap concentration gives greases on the heavy end of No. 1 NLGI consistency after 5000 strokes working.

Stearte G illustrates the extremely high gelling action and soap economy which has been obtained. However, here the prospective user must be cautioned to expect a hard grainy gel and a tough viscous structure which again requires the use of efficient and intensive working equipment for the preparation of a satisfactory finished product. The nature of the base oil apparently has only a minor effect on the results obtained with Stearate G.

The general observation has been that when final ASTM worked penetrations fall below 300, the complete elimination of graininess requires very intensive milling. Where graininess persists, the soap content can usually be lowered. The loss of yield will not be appreciable and a smoother product will be obtained.

Table V shows the effect of soap content (Stearate G) on penetration of greases made with 300 SSU at 100°F. acid treated Mid Continent stock, and Table VI shows effect of soap content on consistency of greases made with 65 SSU at 210°F. Gulf Coastal stock. It will be noted that the development of this stearate has permitted attainment of No. 2 consistency, even after 5,000 strokes, at 6% soap content. Certain grades with 4.% to 5.% of Stearate G have also become commercial realities. This economy has given impetus to the use of aluminum base greases where calcium and sodium base products have been used exclusively heretofore.

Konrad Parker

E. F. Wagner

About the Authors

Konrad Parker received his B.S. in chemistry in 1939 and since that time has concentrated his work in the field of metallic soaps. His first position was in charge of chemical testing for the War Department at an Illinois ordnance plant. Later he went overseas with a construction company of the army engineers. In 1946 he joined WITCO CHEMICAL COMPANY and is now a group leader in the research laboratory in charge of stearates development for the grease industry. He is continuing his studies for an advanced degree in evening courses.

E. F. Wagner, head of technical service division for WITCO CHEMICAL COMPANY, was graduated from Armour Institute of Technology with B.S. and M.S. degrees in Chemical Engineering.

In 1940 after receiving general petroleum refinery training he was assigned to lube oil additive development by Standard Oil Company of Ohio. Later he became process engineer for the lube oil, wax, and grease works.

He returned to a teaching position at Illinois Tech and also worked toward a Ph.D. degree in Chemical Engineering which was received in 1945.

With WITCO since that time he has held positions of chief chemist, director of chemicals development and plant superintendent.

He holds membership in American Institute of Chemical Engineers, Tau Beta Pi, Phi Lambda Upsilon, Sigma Xi, and The American Chemical Society.

TABLE I

Midcontinent Stock 300 SSU at 100°F.			Penetrations Unworked	60 Stroke	5000 Stroke	Delta
6%	Stearate	A	220	350	.....	.....
6%	"	B	185	300	350	165
6%	"	C	170	280	330	160
6%	"	D	180	265	310	130
6%	"	E	205	290	340	135
6%	"	F	185	285	325	140
6%	"	G	150	250	280	130

TABLE II

Pennsylvania Stock SAE 50			Penetrations Unworked	60 Stroke	5000 Stroke	Delta
6%	Stearate	A	210	365	395	185
6%	"	B	170	285	340	170
6%	"	C	125	240	300	175
6%	"	D	155	255	325	170
6%	"	E	165	280	350	185
6%	"	G	140	220	270	130

Aluminum Stearate 22-G

Lithium Stearate

Barium Stearate

Lead Oleate

Lead Naphthenate

Stearite

Calcium Stearate

Aluminum Stearate 22-C

Lead Stearate

Aluminum 23

Aluminum 22

ALUMINUM STEARATE 22-G

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WITCO ALUMINUM STEARATE 22-G is a recently-developed yet thoroughly field-tested product — the result of intensive research. It is an extremely high gelling grease grade Aluminum Stearate. Greases made with 22-G are characterized by unusually high yield, tough body, higher flow point, improved stability, less tendency to bleed. They set up more readily and are more independent of cooling rate — a decided advantage during hot summer months. Complete information and samples of all Witco products are yours upon request.

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Fig. 1. Stainless Steel reactor used for laboratory preparation of experimental stearate.

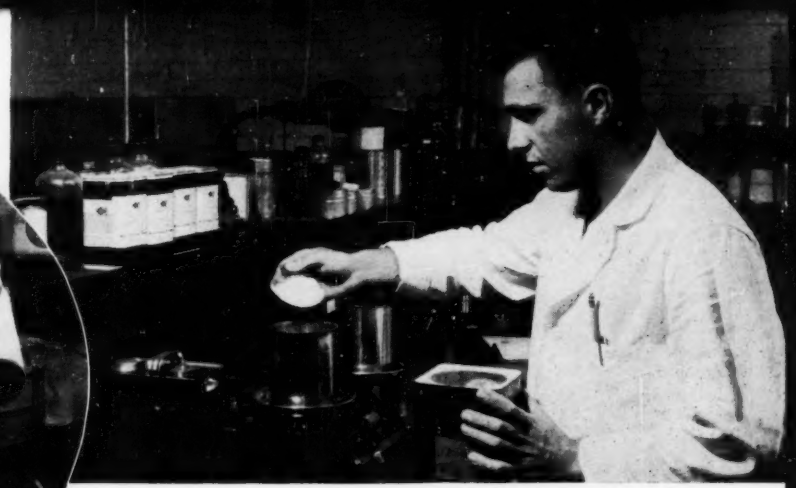


Fig. 2. Stearate being weighed into oil for small grease batch.

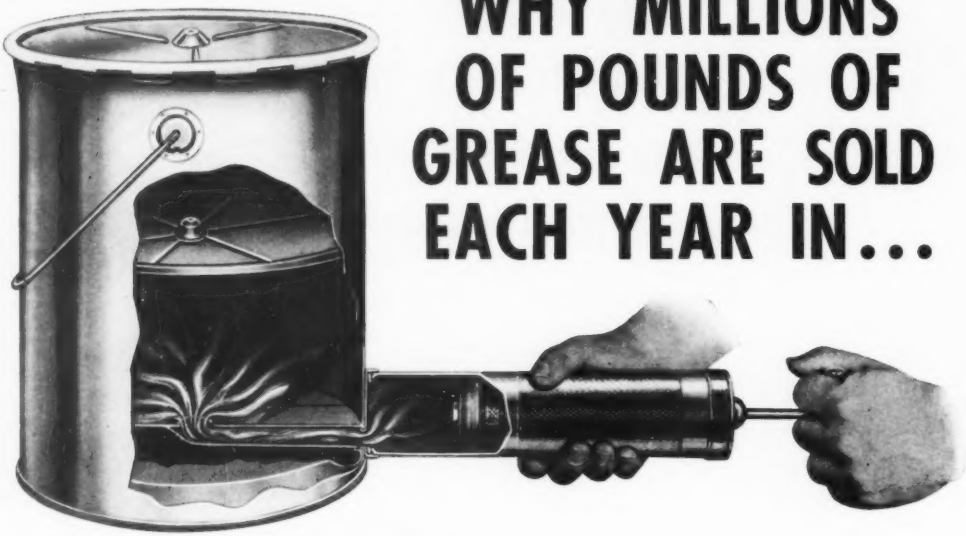
These four pictures show several steps in evaluating a typical stearate grease formulation. "A 6% grease is prepared on a one pound scale from a 300 SSU @ 100°F acid treated Mid-Continent stock. This is tested for consistency and worked stability. The same procedure is used for preliminary screening of experimental products. The stearate is thoroughly dispersed in the cold oil and the mixture is then heated to 300°F on an electric hot plate with constant agitation. The cooling stage is carried out either in a preheated oven or in an insulated drawer of a cabinet. The grease is allowed to rest undisturbed for at least 18 hours before penetration and working tests are made according to ASTM procedures. Observations on color, clarity, and bleeding of the finished grease are also made."

Fig. 3. Mixers used for laboratory scale preparation of greases.

Fig. 4. Consistency determination with ASTM grease worker in background.

Courtesy of Witco Chemical Company

WHY MILLIONS OF POUNDS OF GREASE ARE SOLD EACH YEAR IN...



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IT'S FAST — Because it's simple to use. Just screw the gun into the socket, draw out the plunger and remove the gun. That's all there is to it.
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TABLE III

Gulf Coastal Stock 530 SSU at 100°F.	Penetrations Unworked	60 Stroke	5000 Stroke	Delta
6% Stearate A	220	350	.....	.....
6% " B	175	310	350	175
6% " C	170	305	330	160
6% " D	160	240	305	145
6% " E	185	265	330	145
6% " G	140	215	275	135

TABLE IV

Mid Continent Solvent Refined Residue 2000 SSU at 100°F.	Penetrations Unworked	60 Stroke	5000 Stroke	Delta
6% Stearate A	205	350	385	180
6% " B	185	305	340	155
6% " C	185	305	335	150
6% " D	175	295	340	165
6% " E	185	305	345	160
6% " G	165	245	290	125

TABLE V

Mid Continent Stock 300 SSU at 100°F.	Penetrations 60 Stroke	5000 Stroke
4.0% Stearate G	335	365
4.5% " "	310	345
5.0% " "	290	320
5.5% " "	270	300
6.0% " "	250	280

TABLE VI

Gulf Coastal Stock 65 SSU at 210°F.	Penetrations 60 Stroke	5000 Stroke
3.5% Stearate G	335	365
4.5% " "	295	325
5.0% " "	270	300
6.0% " "	230	260

STABILITY ON WORKING

One of the deficiencies of aluminum base greases has been their lack of stability on working. An examination of Tables I-IV will show that Stearate G in addition to giving maximum yield also decreases the "Delta penetration values." Thus the difference in penetration between 5,000 strokes and unworked has been substantially decreased. In addition further working to 10,000 and even 100,000 strokes will not appreciably reduce the yield. This is shown by respective penetrations of 290 and 310 in the 300 SSU Mid Continent stock.

Greases made with Stearate G are also characterized by higher viscosity at elevated temperatures. This is noticeable by increased power requirements during gelling and subsequent stages of manufacture. Such "toughness" should increase the utility of the finished product. It might be expected that with increased viscosity at elevated temperatures the low temperature characteristics of these greases would be impaired. This does not appear to be the case as products made to the same original consistency with medium high gel (Stearate B) and extreme gel (Stearate G) stearates show comparable penetrations at low temperatures. (Table VII.)

TABLE VII

Low Temperature Penetrations (Greases made from 454 SSU at 100 high V.I. Mid Continent Stock)

	6% Stearate B	4% Stearate G
77°F.	320	320
32°F.	250	260
— 5°F.	160	.....
—10°F.	.....	175

Visual examinations for bleeding were made after six months on one-pound laboratory samples and commercial drum samples. These observations indicated good stability of greases made with high gel strength stearates. The percentage of bleed was definitely not more than with the lower gel types and in many instances there was definite improvement.

OXIDATION RESISTANCE

These stearates have no effect upon oxidation resistance of finished greases. This is shown by results of Norma-Hoffmann bomb tests[2]. Oxygen pressure drop after 100 hours at 210°F. was 3 pounds or less for all of the greases made with the Pennsylvania base stock. As expected the origin and refining treatments of the oils have a great effect on oxidation resistance. Thus greases made with a well refined Gulf Coastal stock and Stearate B showed 5 pounds pressure drop after 98 hours while those made from a solvent refined residue stock showed the same drop after 48 hours.

PLANT METHODS

It has been our experience that the usage of these high gel aluminum stearates does not involve any drastic changes in present plant handling procedures[3]. Thus it seems desirable to pre-slurry or "cream" all of the stearate with one-quarter to one-third the final total quantity of oil. This insures good dispersion and complete wetting. The balance of the oil is then added and heating is begun and continued for a period of several hours. Maximum cooking temperatures in the range 275-325°F. are commonly employed. With the highest gel type of stearate (Stearate G) it is advisable to work toward the 325°F. end. In some plants where maximum available temperature is 250-260°F., the use of medium high gel stearate (Stearate B) is quite successful.

In general the high gel products behave similarly to low gel materials under different methods of cooling. Stearate G however appears to be unusual in that laboratory batches of grease cooled at different rates have the same consistency. Occasionally where heavy unrefined base oil stocks are used it is possible to draw directly into final shipping containers. Most generally aluminum base greases are still cooled in pans, although a number of continuous Votator installations are producing excellent results.

Graininess of the cooled gels will vary with (a) type of oil used (the lighter viscosity stocks showing greatest tendency), (b) with particular blend of oils used, and (c) with cooling rate. To obtain advantages offered by extreme gel stearates it is recommended that some thought be given to installation of equipment for intensively working, homogenizing, and de-aerating the cooled gels. (Several manufacturers have already taken steps in this direction.)

CO-OPERATION

In the past grease makers have had only a limited amount of technical assistance from stearate suppliers. Today laboratory and pilot scale equipment permits the latter to make evaluations on specific oil samples which serve as first approximations of plant scale results. All grease manufacturers, (especially the smaller organizations where laboratory facilities are limited) should take advantage of such technical assistance. Close co-operation will be mutually beneficial and in view of what has already been accomplished the industry can look forward to continued progress toward more economical high quality products.

(2) ASTM Designation D942-47T.
(3) C. J. Boner, *Petroleum Refiner*, Vol. 26, No. 6 p. 127 (1949).

George V. Browning

H. E. Bloomsburg

Bruce B. Farrington

George V. Browning, Whiting Research Laboratory, Standard Oil Company (Indiana)

"A New Approach to Lubricating Grease Structure"

Mr. George V. Browning was awarded a Ph.D. degree at the University of Wisconsin for work done on the thermodynamic and visco-elastic properties of polymer-solvent systems. For his B.A. and M.A. he worked on absorption studies with activated charcoal and the development of an explosive for the Canadian Government, University of British Columbia, Canada.

Browning was born in 1919, Rainy River, Ontario, Canada.

He taught rural school in 1938 and 1939.

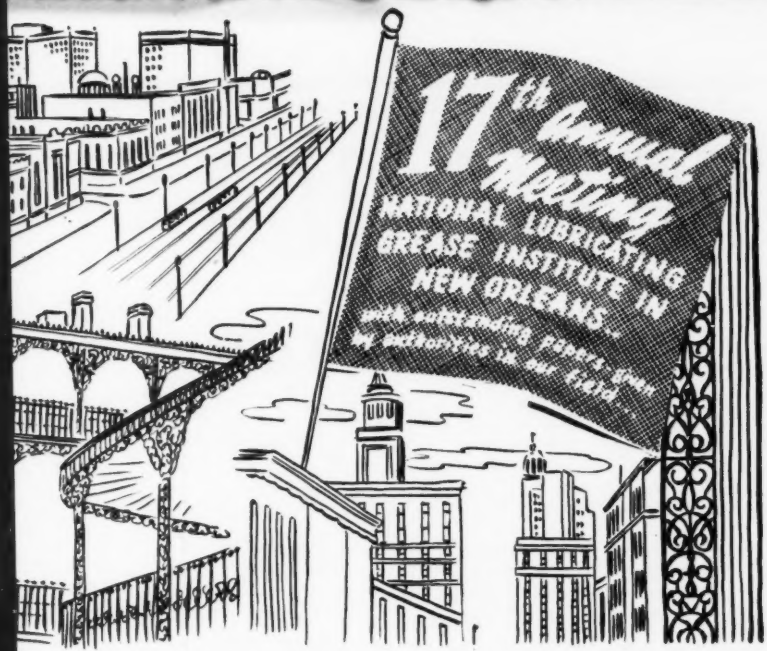
Since receiving his Ph.D. he has been employed by the Standard Oil Company (Indiana).

H. E. Bloomsburg, Esso Standard Oil Company
Co-Author: A. Beerbower

"Plant for Continuous Grease Manufacture"

H. E. Bloomsburg was graduated from John Hopkins, received his M.A. and Ch.E. degrees from Columbia University and joined the Development Department of the Esso Standard Oil Company in 1924. After two years of research on motor fuels and lubricants, culminating in investigation of motor fuel problems in England, Germany, and Denmark, he was appointed assistant technologist in the Manufacturing Department in the New York office. In his continued association with the Manufacturing Department his work has involved product quality and development, and the technical coordination of these activities between Marketing, Manufacturing, and Research Units. He has contributed to the expansion of Esso Standard's Solvent Naphtha business and was instrumental in establishing its present line of Aromatic Solvents. He has been intimately associated also with Esso's grease activities since 1929.

In his present capacity Mr. Bloomsburg is responsible for coordination of quality of all major products and for coordination of quality and supply of greases, solvents, aviation gasoline, and specialties. He is a member of most of Esso's product subcommittees and is Chairman of the Grease and Specialties Subcommittees. He is a member of the American Chemical Society and his honorary societies include Sigma Xi, Tau Beta Pi, and Phi Lambda Upsilon.



Bruce B. Farrington, Research and Development, California Research Corporation
"The Effect of Water and Other Additives on the Fiber Structure of Calcium Soap Greases"

Mr. Bruce B. Farrington was born and raised in California and graduated in chemistry from the University of California.

Joining the Research and Development Department of Standard of California soon after graduation, he has been with that organization and its successor, the California Research Corporation, ever since.

Although Mr. Farrington has been associated with research and development of lubricating greases for many years, he has been granted many patents in the compounded motor oil field on extreme pressure lubricants, metal treating processes, wood preservatives, cleaning fluids, etc. He is now Supervisor of his Company's Grease and Industrial Lubricants Division.

Mr. Farrington's interest in NLGI dates back to a 1930 discussion in Cincinnati with the late Dr. James McKee, when our present Institute was very much in the embryonic state. His interest in the structure of lubricating greases was greatly stimulated by Dr. McKee, and the papers on this subject presented today and previously before this Institute by Mr. Farrington are the direct result of Dr. McKee's enthusiasm and friendship.

E. Ralph Harris, Manager Industrial Sales, Stewart-Warner Corporation
"Lubrication—Then and Now"

Ralph Harris was born in Cantonsville, Maryland, and was graduated from Cantonsville High School. He attended Baltimore Polytechnic Institute and John Hopkins University.

For ten years he served as District Manager of the Cincinnati Balcrank Company. He is now in his fourteenth year with Stewart-Warner Corporation, having had charge of Product Development for a number of years and for the past five years being associated with the Industrial Sales Department and presently Manager of Industrial Sales.

C. Malcolm Finlayson, Mellon Institute of Industrial Research
Co-Author: P. R. McCarthy, Gulf Research and Development Company
"Bentone Greases"

Mr. C. Malcolm Finlayson was graduated from the University of Delaware in 1939 and joined the Central Research Laboratories of the Armstrong Cork Company in Lancaster, Pennsylvania. His initial work was concerned with research on paint, varnish

E. Ralph Harris

C. Malcolm Finlayson

P. R. McCarthy

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and lacquer systems for various industrial applications. Later he was engaged in the development of high-density plywood for military applications during the aluminum shortage. Following a part in a project on the welding of aluminum for aircraft structures, he spent the bulk of the remaining war period developing techniques and processes connected with the manufacture of aircraft canopies from "Plexiglass." Early in 1944 he became Head of the Linoleum and Tile Section of the Plant Laboratory and was responsible for the control and development of the linoleum and asphalt tile operations of the Armstrong Cork Company.

Mr. Finlayson joined the National Lead Company in 1946 and has since been connected with the technical development of the "Bentones," primarily in the lubricating grease field, and is now engaged in the advancement of the "Bentones" in a Technical Sales capacity.

P. R. McCarthy, Gulf Research and Development Company
Co-Author: C. Malcolm Finlayson, Mellon Institute of Industrial Research
"Bentone Greases"

Mr. P. R. McCarthy is associated with Gulf Research and Development Company where, since 1936, he has been engaged in the development and evaluation of lubricating greases.

O. Graziani

O. Graziani, The Werner G. Smith Company
Co-Authors: F. C. Haas and J. D. Hetchler, The Werner G. Smith Company
"Specific Fatty Acids and Glycerides for Lubricating Greases"

A B.S. degree in Chemical Engineering was received by Mr. O. Graziani in 1933 from Lehigh University. He worked for Armour and Company, Chemical Division, from 1933 to 1939. He did research and development work on fatty acids and their derivatives.

In 1939, he joined the Werner G. Smith Company in Wyandotte, Michigan, where he supervises laboratory research and engineering.

C. L. Pope

C. L. Pope, Lubrication Engineer, Eastman Kodak Company
"Industrial Grease Selection"

From 1930 to the present date, Mr. C. L. Pope has been lubrication engineer for Eastman Kodak Co. He services as consultant to all Kodak plants and subsidiaries.

Under the Tennessee Eastman management, he was consultant to Oak Ridge. He is also a consultant to Holsten Ordnance.

Pope attended the Moses Brown Preparatory School and graduated with the class of '26 from Cornell. He had an apprenticeship with Wright Aeronautical. In 1926-1927 he worked with Neidich Cel-Lus-tra Co. and from 1927-1929 he was with The Purchasing General Chemical Co.

T. G. Roehner

S. F. Gale

G. L. Sumner

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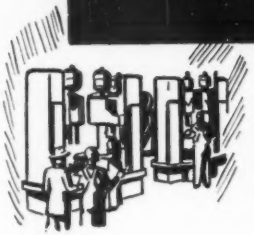

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Mr. Pope is exceedingly active in the lubrication field. He was the first recipient of the Alfred Hunt memorial medal donated by the Aluminum Co. of America. He received the award for presenting the best paper on lubrication before the American Society of Lubrication Engineers.

His activities are as follows: Member of A.S.T.M. and active in these committees of D2, technical committee B lubricating oils, chairman UIIIB, Industrial gear oils, technical committee C turbine oils, technical committee G advisory committee greases; current president of the American Society of Lubrication Engineers; contributed papers to the 1935, 1940 and 1945 annual A.S.M.E. meetings; chairman of the Industrial Applications section of the 1946 A.S.M.E. Petroleum Conference, Tulsa, Okla.; presented the following papers to A.S.T.M.: "Significance of Acid Number", "Eastman Kodak Oxidation and Corrosion Test for Oils", "Purchase Specifications", "Grease Application", "Experience with Turbine Oils". In addition to the above listed activities, Mr. Pope is a member of the Rochester Engineering Society and a member of the Cornell Club of Rochester.

G. L. Sumner, Lubrication Engineer
Westinghouse Electric Corporation

"Lubrication of Electrical Rotating Apparatus"

Mr. George Lewis Sumner was graduated from the Pennsylvania State College in Chemistry in 1914. He entered the employ of the Illinois Steel Company at Gary, Indiana, as Chemist and a year later transferred his affiliations to the National Tube Company at McKeesport, Pennsylvania. In 1917 he accepted a position with the Westinghouse Company at East Pittsburgh, Pennsylvania, as Chemical Engineer in the Research Division. His efforts were largely concentrated on insulating oil development and lubricating problems in the application of cutting oils and lubricants.

He is affiliated with "The Independent Research Committee on Cutting Fluids," is a member of ASTM Committee D-2, acting as NEMA representative for Westinghouse, and is also a member of Sectional Committee Z-II of the American Standards Association on Petroleum Products and Lubricants. His other ASTM activities include membership in Technical Committee J, Section III on "Plant Evaluation of Cutting Fluids"; Technical Committee B, Section UIII on Gear Lubricants; Technical Committee G, Section III on "Functional Tests for Lubricating Greases".

During the war, Mr. Sumner acted as Liaison Engineer on plant lubrication, cutting fluids and finishes to the three Naval Ordnance Plants operated by Westinghouse located at Canton, Ohio; Centerline, Michigan; and Louisville, Kentucky. His present duties as consulting engineer on Petroleum Products and Corrosion Problems include correlation with subsidiary plants.

S. F. Gale, New Orleans Public Service, Inc.

"Reducing the Cost of Bus Maintenance"

Mr. S. F. Gale was born in London, England, in 1899. He received his primary education in England and served as an apprentice with the Association Equipment Company, manufacturers of motor buses and heavy-duty trucks. During the first World War he was in the Royal Air Force.

In 1921, Mr. Gale came to the United States and worked in a public garage while taking a home study course in mechanical engineering. He was employed by the New Orleans Public Service as a draftsman in 1924. He held a number of positions with this company until he left it in 1938 as Equipment Engineer. The next six years were spent with the American Coach and Body Company in Cleveland, Ohio, first as Sales Engineer and then Sales Manager. He returned to New Orleans Public Service in 1944 and was made Superintendent of Maintenance about two years ago.

T. G. Roehner, Director, Socony-Vacuum Laboratories

"Twister Ring Greases"

T. G. Roehner received his Bachelor of Chemistry degree from Cornell University in 1924. He spent six years in Chile, South America, with Braden Copper Company, as Test Engineer and Chemist. In 1930 he joined the Standard Oil Company of New York, and his present position with Socony-Vacuum Oil Co., Inc., is that of Director of the Technical Service Laboratories of Socony-Vacuum Laboratories, Brooklyn, N. Y.

Norman L. Klein, Dept. of Army, Office of Chief of Ordnance
Co-Author: C. W. Kelley

"Operation Grease Ball"

Mr. N. L. Klein is Chief of the Fuels and Lubricants Section, Ordnance Research and Development Division, Office, Chief of Ordnance. Graduated from the Georgia School of Technology with the degree of B.S. in Chemical Engineering, he joined the Research Department of Rohm & Haas Company in Philadelphia, Pa. In 1938 Mr. Klein became affiliated with the Shell Oil Company, Inc., as sales engineer in Baltimore, Maryland, and Richmond, Virginia, where he remained until March, 1942. From March, 1942, until he entered the Army in October of the same year, Mr. Klein was connected with the Petroleum Administration for War. From October, 1942, until January, 1946, when he was separated from the Army with the rank of Major, Mr. Klein was assigned in the Fuels and Lubricants Section, Research and Development Division, Office, Chief of Ordnance, where he was engaged in fuels and lubricants test and development projects. In February, 1946, he was appointed in a civilian capacity to his present position as Chief of the Fuels and Lubricants Section.

C. W. Kelly, Dept. of Army, Office of Chief of Ordnance
Co-Author: Norman L. Klein

"Operation Grease Ball"

Dr. Carl W. Kelley has been a Petroleum Engineer in the Fuels and Lubricants Section, Ordnance Research and Development Division, Office, Chief of Ordnance, since May

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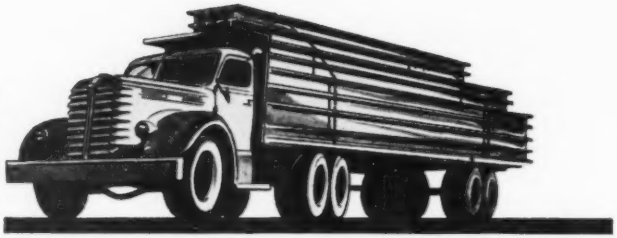

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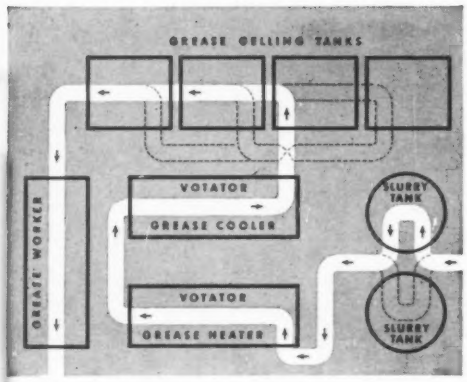

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1948. He received degrees at the University of North Carolina and the University of Maryland.

Petroleum work for Dr. Kelley began with his work in the control laboratories of North Carolina State. From here he progressed to the Briggs Oil Filter Company at Bethesda, Maryland, where he remained until September 1942 when he was commissioned in the Navy. The next four years were spent at the Naval Engineering Experiment Station at Annapolis, Maryland, in the Internal Combustion Engine Laboratory. In May 1946, separated from Naval Service with the rank of Lieutenant Commander, Dr. Kelley became affiliated with the research laboratories of the Shell Oil Company, Inc., at Wood River, Illinois, later moving to the Lubricants Department in the New York office of the company as Senior Staff Engineer.

Wilbur A. Young, Technical Director
Warwick Chemical Company

"Improvements in Aluminum Stearate for Grease Manufacture"

Mr. Wilbur A. Young, who will present a paper on "Improvements in Aluminum Stearate for Grease Manufacture", is with the Warwick Chemical Company.

He is 40 years of age and has worked for the Bell Telephone Laboratories, Colgate-Palmolive-Peet Co., M. W. Parsons, and Warwick Chemical Co.

Young is a member of: A.C.S., American Association for the Advancement of Science, and the Society of Cosmetic Chemists.

He was educated in New York City.

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Monday, October 3, 1949

MORNING SESSION—10 a.m.—Ballroom

Address of Welcome—Mr. B. G. Symon, President N.L.G.I Shell Oil Company, New York City, New York

"A New Approach to Lubricating Grease Structure"
George V. Browning, Whiting Research Laboratory

"The Effect of Water and Other Additives On the Fiber Structure of Calcium Soap Greases"
Bruce B. Farrington, Research and Development, California Research Corporation

12:30 p.m. BOARD LUNCHEON—Pan American Room

AFTERNOON SESSION—2 p.m.—Ballroom

"Bentone Greases"
C. Malcome Finlayson, Mellon Institute of Industrial Research
Co-Author: P. R. McCarthy, Gulf Research and Development Company

"Specific Fatty Acids and Glycerides for Lubricating Greases"
O. Graziani; Co-Authors: F. C. Haas and J. D. Hetchler, The Werner G. Smith Company

"Twister Ring Greases"
T. G. Roehner, Director of the Technical Service Department, Socony-Vacuum Laboratories

"Plant for Continuous Grease Manufacture"
H. E. Bloomsburg; Co-Author: A. Beerbower, Esso Standard Oil Company

ANNUAL BUSINESS MEETING—4:30 p.m.—Ballroom

Tuesday, October 4, 1949

MORNING SESSION—9 a.m.—Ballroom

"Improvements in Aluminum Stearate for Grease Manufacture"
Wilbur A. Young, Technical Director, Warwick Chemical Company

"Industrial Grease Selection"
C. L. Pope, Lubrication Engineer, Eastman Kodak Company

"Lubrication of Electrical Rotating Apparatus"
G. L. Sumner, Lubrication Engineer, Westinghouse Electric Corporation

"Lubrication—Then and Now"
E. Ralph Harris, Manager of Industrial Sales, Stewart-Warner Corporation

12:30 p.m.—BOARD LUNCHEON—Pan American Room

AFTERNOON SESSION—2 p.m.—Ballroom

"Operation Grease Ball"
C. W. Kelley; Co-Author, Norman L. Klein, Department of Army, Office of Chief of Ordnance

"Bus Lubrication and Maintenance"
S. F. Gale, Superintendent of Maintenance, New Orleans Public Service, Incorporated

"Steel Mill Lubrication"
Kenneth McHenry, Lubrication Engineer, Bethlehem Steel Corporation

6:00-6:50 p.m.—SOCIAL HOUR—Gold Room

7:00 p.m. BANQUET—Main Ballroom, Floor show in Night Club Style

Wednesday, October 5, 1949

MEETING—TECHNICAL COMMITTEE—10:00 a.m. —Ballroom

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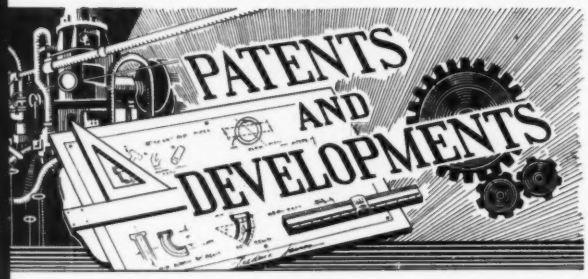

NON-BLEEDING STABLE GREASES—Oxidation and water-resistant, non-bleeding soap-containing greases having outstanding mechanical stability and thermal reversibility have been described in a patent issued to Shell Development Co. Milling or homogenizing are said to be not essential in producing a non-bleeding product. Use is made of a soap made from a mixture of two fatty materials comprising a hydroxy fatty acid and a hydrogenated fatty acid, the saponifiable materials being of high molecular weight, preferably having 14-22 carbon atoms. The hydroxy fatty acids may be obtained by naphtha extraction of oxidized fatty acids. Hydrogenated fish oil fatty acids are preferred as the other component. The specific metal ions which may be used for the soaps are sodium, lithium, cesium, rubidium, calcium, strontium, barium, cadmium, zinc, aluminum, lead, etc. The amount of soap in the grease may be 5-25%.

Bleed inhibitors such as alkali or alkaline earth metal salts of a saturated cyclic hydrocarbon carboxylic acid (e.g. naphthenic acid), or alkylene glycol polymeric materials can be added. The latter have molecular weights in the range 400-7000, and the amount used is in the range of 0.1-1%. Anti-wear agents, such as oil-soluble urea or thiourea derivatives, e.g. urethanes, allophanates, carbazides, carbazones, etc., may be added, as well as rubber, polyisobutylene, polyvinyl esters, etc., and VI improvers such as voltolized paraffin wax, unsaturated polymerized esters of fatty acids and monohydric alcohols, oiliness agents such as stearic and oleic acids.

Quick cooling in the absence of any shearing stress (i.e. while the grease is in the quiescent state) gives an improved product. This may be done by feeding the grease onto a steel belt and subjecting it to a current of air, thus giving an unusually smooth grease having a higher consistency with less soap than a grease containing a greater amount of soap but cooled by conventional means. The belt should be at least 100 feet long and moved at a speed of about 13 feet per minute, the grease thickness being 1/16"-¼". Further improvement may be obtained by breaking up the chilled mass in a screw conveyor and pumping it through 60-mesh screens, or a Cornell homogenizer (U.S. 2,475,589).

PLUG VALVE GREASE—One patent issued to Rockwell Manufacturing Co. describes a method of preparing a synthetic ethylene polysulfide polymer of desired viscosity for use as a plug valve lubricant, comprising reacting an aqueous sodium polysulfide solution having a sodium polysulfide ratio of $Na_2S_{3.5}$ to Na_2S_4 with ethylene dichloride to produce a polymeric ethylene polysulfide material and heating the material at 380°F.-400°F. for 1-1½ hrs. to convert it to a lubricant of desired viscosity (U.S. 2,474,859).

PAPER MACHINE LUBRICATION—The July issue of *Lubrication* discusses lubrication of the modern paper machine, including the use of proper greases.

SILICONE GREASES—Dow Corning Corp. has issued its "Silicone Notes D-5 and D-6" discussing data on silicone greases and their use in bearings of electric motors. Relative bleed and evaporation data of various silicone and petroleum greases are given at 300°F. and 390°F.

TESTING AUTOMOTIVE GEAR LUBRICANTS—Workers at the Bureau of Standards claim that accurate measurements of wear with various automotive gear lubricants under simulated service conditions can be obtained with a modified SAE extreme-pressure lubricant testing machine. It is claimed to provide a sensitive means for evaluating lubricants with respect to wear at high torque and low speed operation, and is suitable for long-time tests (Petroleum Processing 7-49, p.804).

NON-SEPARATING GREASES—Stable dispersions of metal soaps in lubricating oils, either anhydrous or containing water, are claimed in a Shell Oil Co. patent. Glycols having more than 4 carbon atoms (such as dodecene glycol, cetene glycol, hydrates of polymers of propylene oxide, e.g., dipropylene glycol and tripropylene glycol, etc.) have been found to be suitable stabilizers for the dispersions. The metal constituent may be sodium, potassium, lithium, calcium, aluminum, or barium, or mixtures of these, may be used. If fatty acids are used for making the soaps, they should preferably contain 12 or more carbon atoms per molecule, e.g. lauric, myristic, palmitic, stearic, montanic, oleic, behenic, linoleic and linolenic (Brit. Pat. 622,945).

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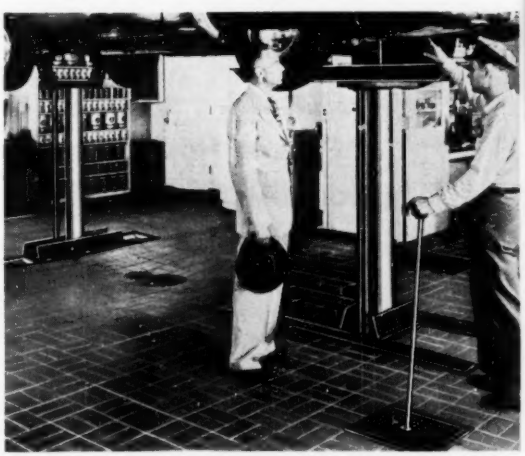

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Joyce Shopmaster Lift through its paces. The mechanic can adjust the rear axle supports and control movement of the lift from the same general location.

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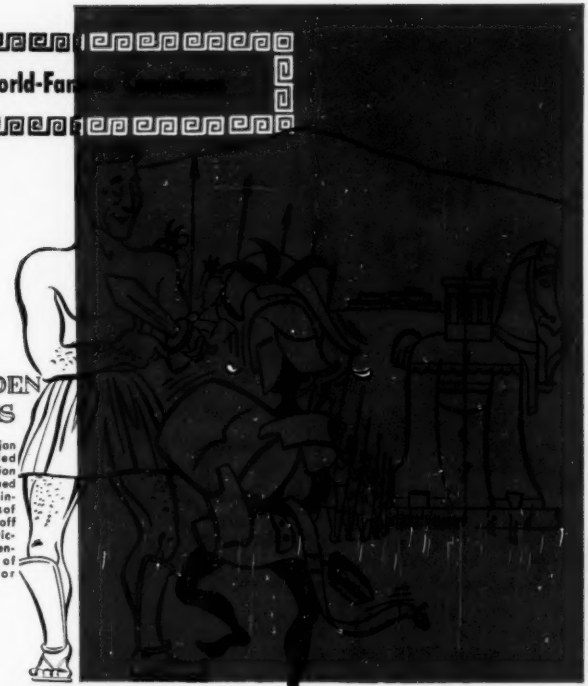

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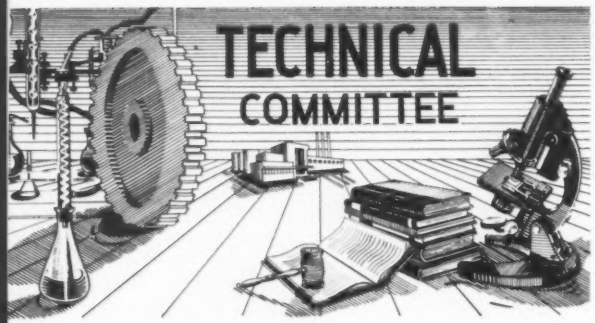

Chairman T. G. Roehner, Director of the Technical Service Department, Socony-Vacuum Laboratories

In the previous issue of this column mention was made of the meeting of ASTM Technical Committee G, on June 27th, in Atlantic City, New Jersey. The opinion was expressed that healthy progress was indicated for each activity of the long list of projects on the development of improved chemical and physical tests for lubricating greases. The minutes of that meeting have been distributed and the following are some of the high points thereof.

The Proposed Method of Test for Apparent Viscosity of Lubricating Greases has been advanced to the point where it is recommended for publication for information in the D-2 Book of Standards for 1949.

The Oxidation Stability of Lubricating Greases by the Oxidation Bomb Method is now on the books as D-942-47T. Steps were taken to establish its repeatability and reproducibility preparatory to recommending advancement of this method from tentative to standard. Consideration was also given to further work involving the use of non-ferrous metals as oxidation promoters. It will be recalled that the basis for this activity was presented in the ABEC-NLGI Cooperative Committee's report "The Norma-Hoffmann Oxidation Test for Lubricating Greases—Technical Bulletin No. 6", dated January 1946, which was made available to ASTM for that purpose.

The Standard Method of Test for Cone Penetration of Lubricating Grease, D-217-48, was reviewed and steps were taken to append thereto the method employing the so-called Motorized Worker for obtaining penetrations of samples worked more than 60 strokes.

Work was again started on the grease industry's perennial problem of standardizing methods for obtaining the consistency of semi-fluid greases.

Discussion of the status of storage stability tests, with particular reference to oil bleeding, indicated that of the various methods proposed to-date, that involving centrifuging is favored.

The ABEC-NLGI Cooperative Committee's activities were again referred to in connection with ASTM Technical Committee G's program for the development of a method for obtaining the dirt count in greases. Incidentally, because it was known that this program would be started, the ABEC-NLGI Committee postponed further work on their part until an ASTM Method is published.

The Evaporation Test for High Temperature Greases continues to receive close attention, with the objective of improving the design of the evaporation cell and the test conditions. Both the micro penetrometer and micro worker are also subjects of further work.

The Proposed Method of Test for Performance Characteristics of Wheel Bearing Grease, which was published for information only in the 1948 D-2 Book of Standards, will not be advanced beyond that point. Experience during the past year has definitely indicated that the mehod should be revised, particularly in respect to speed, in that the spindle rpm would be increased from 440 to 660 rpm, or from the equivalent of about 40 mph to 60 mph road speed. Moreover, some improvement is desirable in expressing the results of the test, in order that they will be less subject to the so-called human equation.

Progress was also made on the three other functional type tests, namely, High Temperature Anti-Friction Bearing Grease Tester, Sub-Zero Torque Tester, and the Water Resistant Grease Tester.

The report of the results of the thixotropic studies on a wide range of greases showed that considerable progress had been accomplished toward the objective of developing a procedure for measuring the thixotropic properties of greases.

Details regarding all of the above projects will be available at the meeting of the NLGI Technical Committee, on October 5th, in New Orleans, La.

We are sure that Mr. R. C. Adams, Chairman of ASTM Technical Committee G, whose address is U. S. Naval Engineering Experiment Station, Annapolis, Maryland, would welcome any comments regarding the above mentioned projects.

A survey was made during the month of August, covering the entire membership of the NLGI Technical Committee, to obtain their ideas regarding the subjects to be put on the agenda for the October 5th meeting. It is planned to distribute this agenda at least two weeks ahead of that date, so that the members will be forewarned and have a better opportunity to present data supporting any comments they wish to contribute toward the discussions of the various subjects. The replies received to-date from the aforementioned survey have been quite encouraging. The agenda undoubtedly will include items of direct interest to everyone interested in the technical problems of the grease industry.

Deep Rock Oil Appoints Doctor Anderson Director of Research and Development

Dr. Nils K. Anderson has been named Director of Research and Development for the Deep Rock Oil Corporation, it was announced by William J. Carthaus, Vice President in Charge of Manufacturing and Research.

For the past three years Dr. Anderson has been Associate Professor of Chemical Engineering at Northwestern University. From 1941 to 1946, he was on the staff of Universal Oil Products Company, working in engineering, research, and development.

Dr. Anderson received his Bachelor of Science degree in chemical engineering from the Armour Institute of Technology in Chicago, and received his Ph.D. from the University of Wisconsin in 1941.

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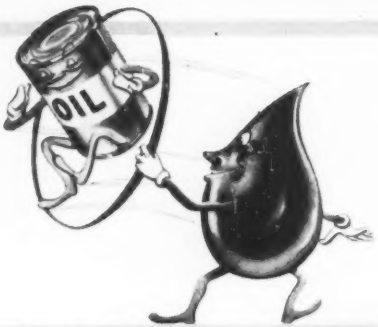

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Cincinnati 9, Ohio
Member—R. P. Field

The Fil-Rite Company
342 Lumber Exchange Building
Minneapolis, Minnesota
Member—Howard G. Hornibrook

Gray Company, Inc.
60—11th Avenue Northeast
Minneapolis 13, Minnesota
Member—L. L. Gray

Lincoln Engineering Company
5730 Natural Bridge Avenue
St. Louis, Missouri
Member—Foster Holmes

National Sales, Inc.
812 North Main St.
Wichita, Kansas

Stewart-Warner Corp.
1826-1852 Diversey Parkway
Chicago, Illinois
Member—Walter Duncan

U. S. Air Compressor Company
5300 Harvard
Cleveland, Ohio
Member—F. J. Coughlin

LABORATORY EQUIPMENT & SUPPLIES

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